



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*



**FACULTY OF ENGINEERING**

***DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING***

FINAL YEAR PROJECT REPORT

**“RE-DESIGNING QUARRY SLOPE BY NUMERICAL  
MODELLING.”**

***CASE STUDY: SEYANI INTERNATIONAL COMPANY LIMITED QUARRY***

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fulfilment of the Requirements for the Award of a Bachelor of Science in Mining Engineering.*

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## **Abstract**

Mining contributes considerably to the wealth of Uganda and the world as a whole, of which open pit quarrying has its fair share of contribution. The number of operating open mines/quarries is steadily increasing as compared to underground mines; this is due to low gestation period, higher productivity, and quick rate of investment. Open pit mining/quarrying is a mining method that involves design of rock slopes, which should remain stable for the duration of the mining. The economic impact of excessively conservative design or of failures in these slopes can be very large and every effort is required for an optimized design. Slope failures of any kind, if not properly managed, can have an effect on production, result in loss of ore reserves, cause pit abandonment/premature closure of the mine, represents a safety hazard for mining personnel, which in extreme circumstances could result in loss of life.

Against this backdrop, there is a strong need for good practices in slope design and management to ensure timely, suitable corrective actions to minimize the slope failures. Rock slope failures are events controlled by natural physical processes.

In Uganda, most slopes designs depend on the field experience, rules of thumb with some sound engineering judgment and to a small extent using limit equilibrium and rock mass classification methods. Limit equilibrium methods deal with structurally controlled planar or wedge failures and circular or non-circular failure in homogeneous materials. Rock mass classification methods deal with the preliminary design phase when very limited rock mass data is available.

The aim of the project was to apply numerical modelling in design of slopes considering different rock properties (Alzo'ubi and Alzo 'ubi 2016). Developed numerical models using FLAC SLOPE.v5.00 for finding out the factor of safety. Varied the parameters for each slope and for each had the factor of safety calculated for each step. Correlated these values with the bench parameters to find out how the factor of safety changes with changing parameters.



### Declaration

I, OKELLO JONATHAN REG. NO: BU/UG/2014/2028, do hereby declare with academic honesty that with the exception of work and quotes of other people, which I have fully referenced to and acknowledged herein, this report is the result of my own original research work. No part of it has been submitted in pursuit of another degree in this University or anywhere else.

Signature: 

Date: 29 / 05 / 2018





### Approval



This is to certify that the Final Project report entitled “**RE-DESIGNING QUARRY SLOPE BY NUMERICAL MODELLING**” submitted by OKELLO JONATHAN REG. NO: BU/UG/2014/2028 in partial fulfilment of the requirements for the award of Bachelor Science in Mining Engineering at Busitema University is an authentic work carried out by him under supervision and guidance.

To the best of my Knowledge, the matter enclosed in this report has not been presented for the award of any Degree or Diploma or similar title of any University or Institution.

ENG. NASASIRA MICHEAL BYAMUKAMA

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The Almighty God should bless you abundantly.



### **Dedication**

I dedicate this report to my family in appreciation for their selfless care and unflinching support provided to me since childhood, and for the spirit of hard work, courage and determination instilled into me, which attributes I have cherished with firmness and which have indeed made me what I am today.

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## CHAPTER 1. INTRODUCTION

This chapter describes the background information of the project, the problem statement, significance, purpose, objectives and scope of the study. The problem statement describes the research problem and identifies potential causes and a solution. The significance describes the importance of the project. The specific objectives presented will achieve the main objective.

### 1.1 Background;

Mining contributes considerably to the wealth of Uganda and the world as a whole, of which open pit quarrying has its fair share of contribution. The number of operating open mines/quarries is steadily increasing as compared to underground mines, this is due to low gestation period, higher productivity, and quick rate of investment (Vaziri *et al.* 2010). Open pit mining/quarrying is a mining method that involves design of rock slopes which should remain safe for the duration of the mining (Keaton 2007). Design of rock slopes involves the determination of optimal bench angle, height of benches overall slope angle, optimal widths for spill berms and ramps (Er *et al.* 2015).

The economic impact of excessively conservative design or of failures in these slopes can be very large and every effort is required for an optimized design. Slopes need to be as steep as possible to minimize the amount of waste rock mined and hence to minimize mining cost, but the economic consequences of failure of slopes due to over-steepening can be disastrous. Factors taken into account in the design of rock slopes are the geological structure, ground water conditions, blasting practice, slope plan geometry and seismic activity of the area (Contreras 2015).

In addition, slope failures of any kind, if not properly managed, can have an effect on production, could result in loss of ore reserves, can cause pit abandonment/premature closure of the mine, represents a safety hazard for mining personnel, which in extreme circumstances could result in loss of life. On large scale it may also affect the surface surrounding the open excavation, which may involve structures and infrastructure (Stacey *et al.* 2003).

Rock slope failures are however, events controlled by natural physical processes. Geological geotechnical models that can be used to understand and to analyse these processes often include structural data as well as information on lithology,

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